PATENT SPECIFICATION

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COMPLETE SPECIFICATION

NO DRAWINGS

Improvements in or relating to Metal Powders and Articles made therefrom

We, THE BIRMINGHAM SMALL ARMS COMPANY LIMITED, of Armoury Road, Small Heath, Birmingham 11, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention concerns improvements in the composition of the mixture of ferrous metal powders from which ferrous alloy components are made by the process of powder metallurgy, so as to effect improvements in the mechanical properties of the sintered pieces.

The manufacture of ferrous alloy components is usually commenced by the process of mixing the elemental powders in the correct proportions to achieve the composition desired. It has been found that materials made from mixtures of powders of differing compositions have considerably better mechanical properties than those made from pre-alloyed powders, each particle of which is of homogenous chemical composition and thus this invention is concerned only with alloys made by sintering a mixture of powders of differing compositions.

The compositions provided by this invention are as follows, the proportions being by weight:

Nickel	from 0.5 to 6%
Copper	from 0.5 to 5%
Manganese	from 0.5 to 4%
Boron	from 0.01 to 0.4%
Carbon (graphite)	from 0.05 to 1.5%
Iron and usual impurities.	the remainder

The nickel may be added as fine carbonyl powder or as a powdered alloy with one or two of the other metals present. In either eventuality its particle size should preferably be such that it will all pass through a 300 mesh B.S.S. sieve.

The copper may be added as elemental powder or as a powdered alloy with one or two of the other metals present. In either eventuality its particle size is preferably such that it will all pass through a 300 mesh B.S.S. sieve.

The boron may be added in any suitable form. While it may be added as such in the form of so-called amorphous boron, it may also be added in the form of one or more key alloys (e.g. ferro-boron) or in the form of one or more chemical compounds of boron. Of the latter the metallic borates may be specially mentioned, cupric borate being an example.

The carbon is preferably added as fine graphite powder ("micronised graphite").

The iron is preferably added as a soft powder that passes completely through a 100 mesh B.S.S. sieve, 75% passes through a 200 B.S.S. mesh sieve and 50% passes through a 300 B.S.S. mesh sieve.

Having weighed out the ingredients the powders are thoroughly mixed to produce a homogeneous mixture and at this stage lubricants such as paraffin wax or stearates or other lubricants well known in the art may be incorporated in the desirable proportions.

The powder mixture is then compacted under a pressure of at least 15 tons per square inch and after ejection from the die the compact is sintered in an atmosphere that prevents oxidation at a temperature between 1100°C. and 1400°C. for at least 5 minutes.

It will be appreciated that although the use of the lower limits of pressing load, sintering temperature and time at temperature tend to give inferior results, the products are such that they may be accept-

able for certain purposes.

An example of the enhanced mechanical properties conferred by following the procedure of this invention, the following shows in tabular form the tensile strengths and elongations of products produced by compacting the powder mixture at 24 t.s.i. and sintering for 15 minutes at 1140°C.

Percentage Composition						Tensile strength tons/sq.in.	Elongation %
Ni	Cu	Mn	C	Copper borate	Fe		
2.4	1	1.6	0.8	0.2	Bal.	21.0	2

WHAT WE CLAIM IS:—

1. A mixture of metal powders from which ferrous alloy components may be made by the process of powder metallurgy, the mixture consisting of the following, the percentages being by weight:—

Nickel	from 0.5 to 6%
Copper	from 0.5 to 5%
Manganese	from 0.5 to 4%
Boron	from 0.01 to 0.4%
Carbon (graphite)	from 0.05 to 1.5%

the remainder being iron plus the usual impurities.

2. A mixture according to claim 1 wherein nickel is added as fine carbonyl powder.

3. A mixture according to claim 1 wherein nickel is added as a powdered alloy with one or more of the other metals present.

4. A mixture according to claim 1 wherein boron is added in the form of amorphous boron or a chemical compound of boron.

5. A mixture according to claim 1 wherein the boron is added in the form of copper borate.

6. A mixture of metal powders from which ferrous alloy components may be made by the process of powder metallurgy, the mixture consisting of the following, the percentages being by weight:—

Nickel	2.4%
Copper	1%
Manganese	1.6%
Carbon (graphite)	0.8%
Copper borate	0.2%

the remainder being iron plus the usual impurities.

7. A mixture according to any preceding claim wherein all the powders other than iron powder are such as to pass through a 300 mesh sieve of British Standard Specification.

8. A mixture according to claim 6 wherein the iron powder is such that it will pass completely through a 100 mesh sieve of British Standard Specification, that 75% of it will pass through a 200 mesh sieve of British Standard Specification and 50% of it will pass through a 300 mesh sieve of British Standard Specification.

9. A ferrous alloy component manufactured from a mixture according to any preceding claim by powder metallurgy.

10. Method of manufacture of a ferrous alloy component from a mixture according to any of claims 1 to 6 comprising the steps of compacting the mixture in a die under a pressure of at least 15 tons per square inch, and sintering the compact after removal from the die in a non-oxidising atmosphere at a temperature between 1100°C and 1400°C for at least 5 minutes.

11. A ferrous alloy component manufactured by the method according to claim 10.

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